SMERC
UCLA Smart Grid Energy Research Center

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Source: California VGI Roadmap: Enabling Vehicle-based grid services, February 2014, CAISO

- "The intention is to keep consumers in the driver's seat."
- "Eventually, two-way interfaces between EVs and the bulk power network ..."
- "… to lead to EV charging behavior that is beneficial or at least not adverse to grid reliability."
- "…aggregation of EV resources that can be bid into the ISO's wholesale market …"
- "… to contribute to reliable management of the electricity grid."
- " At a minimum… do not increase peak load, requiring additional generation or capacity expansions."
- "Ideally, charging is coordinated with grid conditions and the ability for aggregation of EVs to respond to grid operator signals"

Smart Grid Energy Research Center (SMERC)

- **Major sponsors**
  - DOE Funded Regional Demo Grant – LADWP, UCLA, USC, JPL-Caltech
  - KIER-UCLA Smart Grid Grant
  - California Energy Commission - DR
  - DOE Funded EPRI, NESCOR Grant – EPRI + several DOE, University partners
  - SMERC IPP (Industry Partners Program): 18 industry members
  - CEC – Bi-directional EV charging
  - LAEDC / CEC partnership
- **Industry Thought Leadership Forums – every six months**
- **Smart Grid Living Lab (SMERC LL)**
  - UCLA has its own natural gas cogeneration power plant
  - UCLA gets a fraction of its power from LADWP, the local utility
- **External Leadership Council (SMERC LC)**
- **Publish research papers (> 20 publications on EV – Grid research)**
- **Educational programs (courses, training workshops, demonstration days)**

UCLA Mechanical & Aerospace Engineering (mae.ucla.com)

$60 million LADWP smart grid project to be tested at UCLA, USC — UCLA Mechanical and Aerospace Engineering

$60 million LADWP smart grid ...

www.mae.ucla.edu/news/news-archive/2009/60-million-ladwp-smart-grid-project-to-be-tested-at-ucla-usc

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UCLA Engineering

Mechanical and Aerospace Engineering

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- $60 million LADWP smart grid project to be tested at UCLA, USC
- Pirouz Kavehpour wins the prestigious Gallery of Fluid Motion Exhibit
- Greg Carman, engineers, doctors at UCLA develop novel material that could help fight arterial disease
- Chih-Ming Ho receives National Taiwan University's distinguished alumnus award
- Chris Lynch new ASME Aerospace Division Executive Committee chair
- Laurent Pilon awarded 2009 JQSRT Young Scientist Award in Radiation Transfer
- Katie Bulgrin is a SEE-LA

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$60 million LADWP smart grid project to be tested at UCLA, USC

December 8, 2009

Rajit Gadh

Excerpted from the Los Angeles Times.

The federal government today awarded Los Angeles a $60-million grant to help modernize the city's electrical power system.

The money will be used for "smart grid" demonstration projects at USC and UCLA. The projects will allow the city's Department of Water and Power, the largest municipal utility in the nation, to use advanced meters and other technology at the universities to chart how power is being consumed, forecast demand and potential outages, and seek ways to reduce energy use.

Please read the full Los Angeles Times article **here**.

Also, please read the article at www.engineer.ucla.edu.

UPDATE: On 1/14/10, UCLA Today published an in-depth article on Smart Grid.

Print this

UCLA Smart Grid Energy Research Center (SMERC)

WINSmartGrid™ - Two-way communications

The UCLA WINSmartGrid™ is a network platform technology that allows electricity operated appliances such as plug-in automobile, washer, dryer, or, air conditioner to be wirelessly monitored, connected and controlled via a Smart Wireless hub.

EV Integration to the Grid – V1G, V2G

California constitutes a significant automotive market - a place where demanding and energy-conscious consumers come together with creative designers from Hollywood, resulting in an environment rich in ideas on automotive innovation.

Demand Response

Automated load control in smart buildings, smart offices, smart homes, smart appliances, renewable integration and local storage.

EV+ Used EV battery : Peak reduction, V2B

Using battery energy storage to reduce demand charges due to peaky loads such as Fast EV charge such as Chademo.

Microgrids

Comm, sense and control for integrating renewables, EVs and smart loads

Transactive Control of Smart Grids

Price based high speed control of smart loads, EVs, and storage.

Electric Vehicles – EVs available in todays market

Scion iQ EV

Fiat 500e

Toyota RAV4 EV

Chevy Spark EV

Smart Electric Drive

BMW ActiveE

uubishi i-MiEV

Honda Fit EV

Ford Focus Electric

Tesla Model S

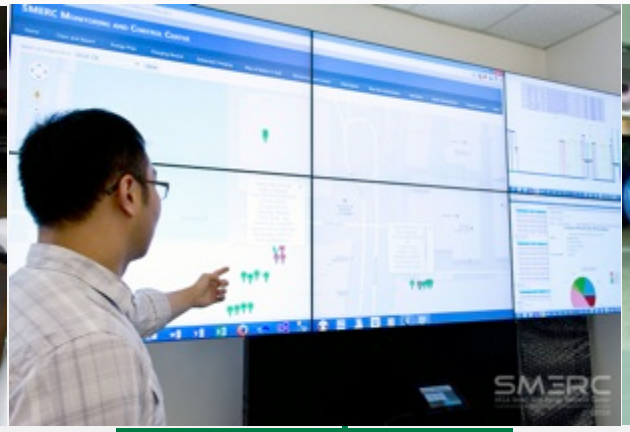
Nissan Leaf

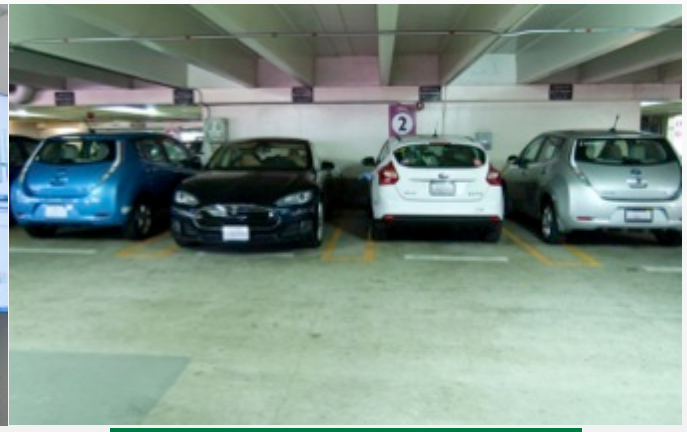
Toyota Prius Plug-in

Chevy Volt

EV Smart Grid Integration:

Fundamental Approach

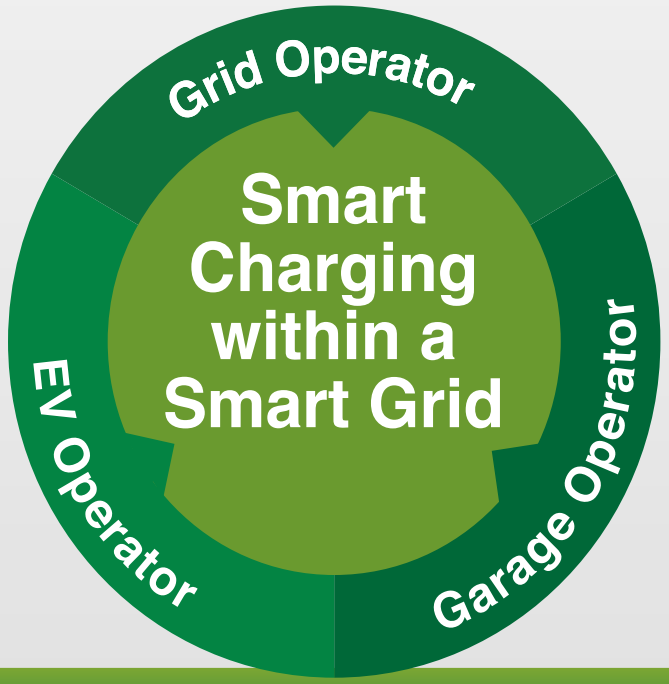




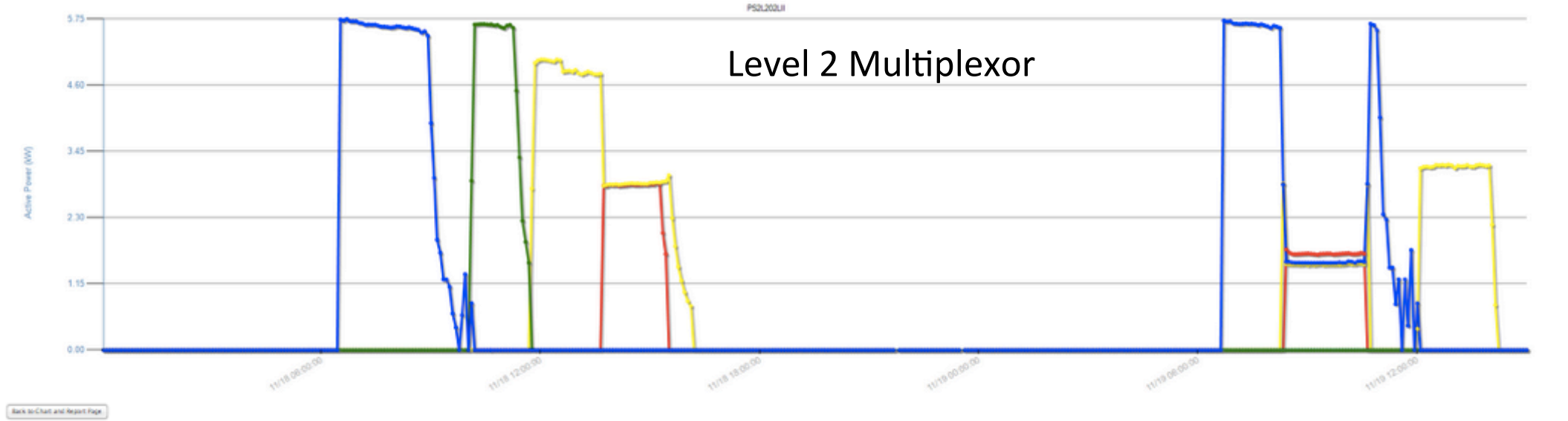
EV Operator

Grid Operator

Garage Operator



Level 2 technology – bidirectional communications and smart scheduling, price-bids and controls for V1G



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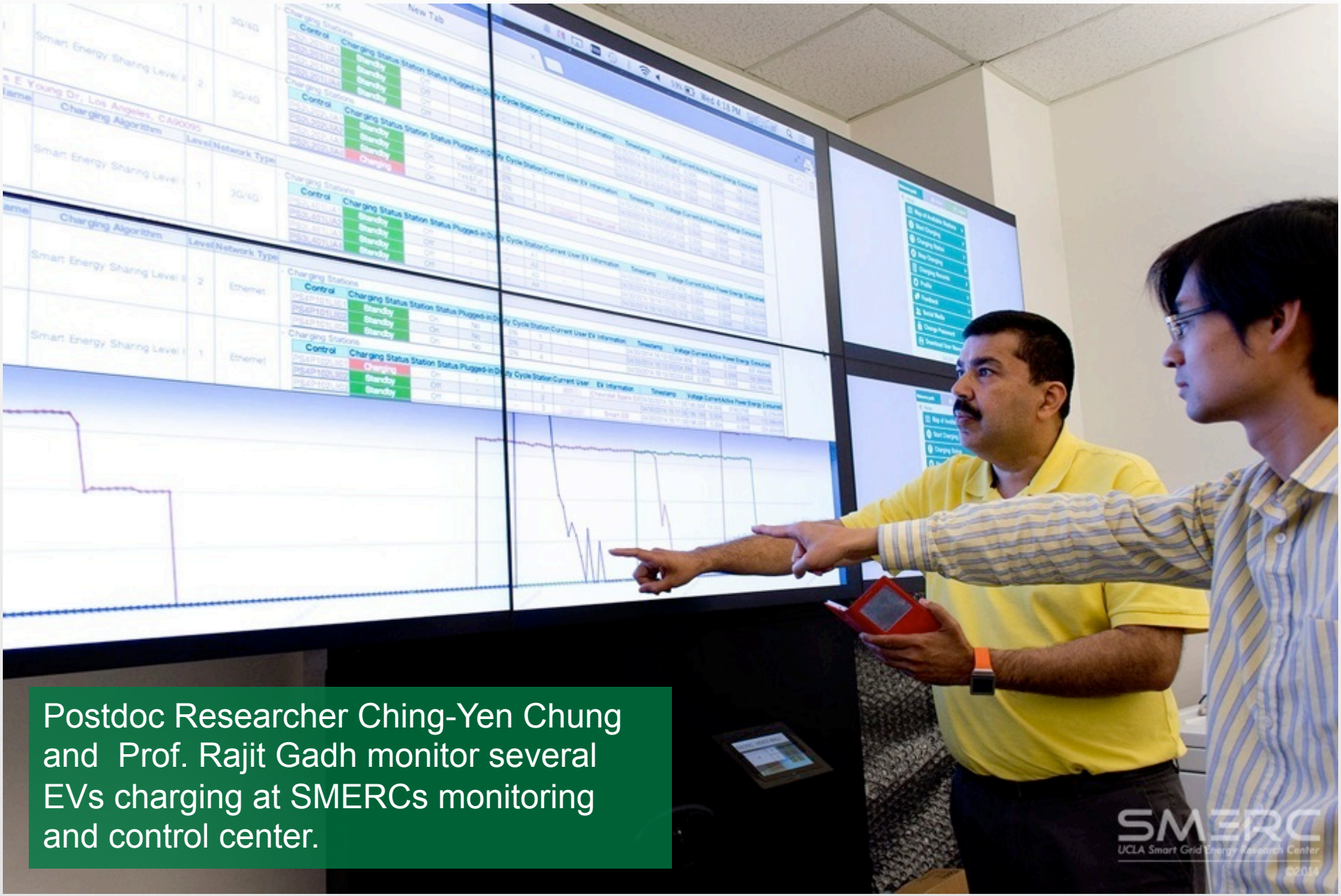
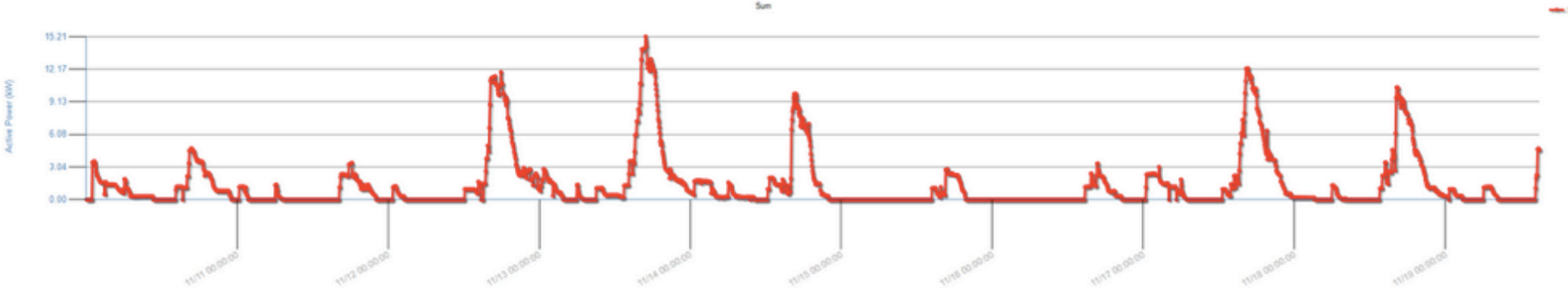
WINSmartEV™ Mobile Web App – EV driver engagement and education

Real Time Monitoring & Control Center FOR Grid operator and aggregator

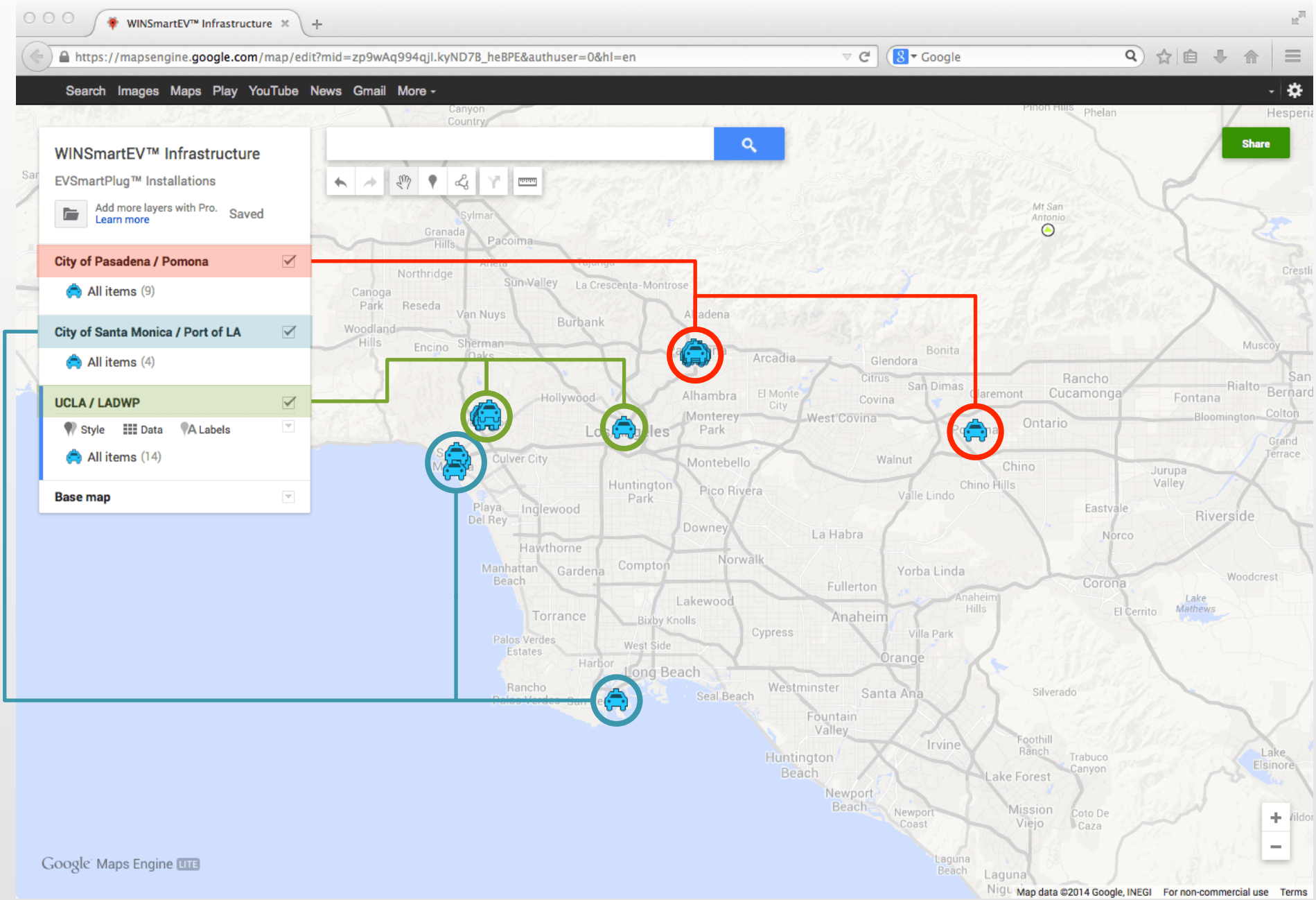


Postdoc Researcher Ching-Yen Chung and Prof. Rajit Gadh monitor several EVs charging at SMERCs monitoring and control center.

UCLA Fleet @ Sunset Village Parking – V1G via aggregator



WINSmartEV™ Infrastructure: Los Angeles / UPDATE

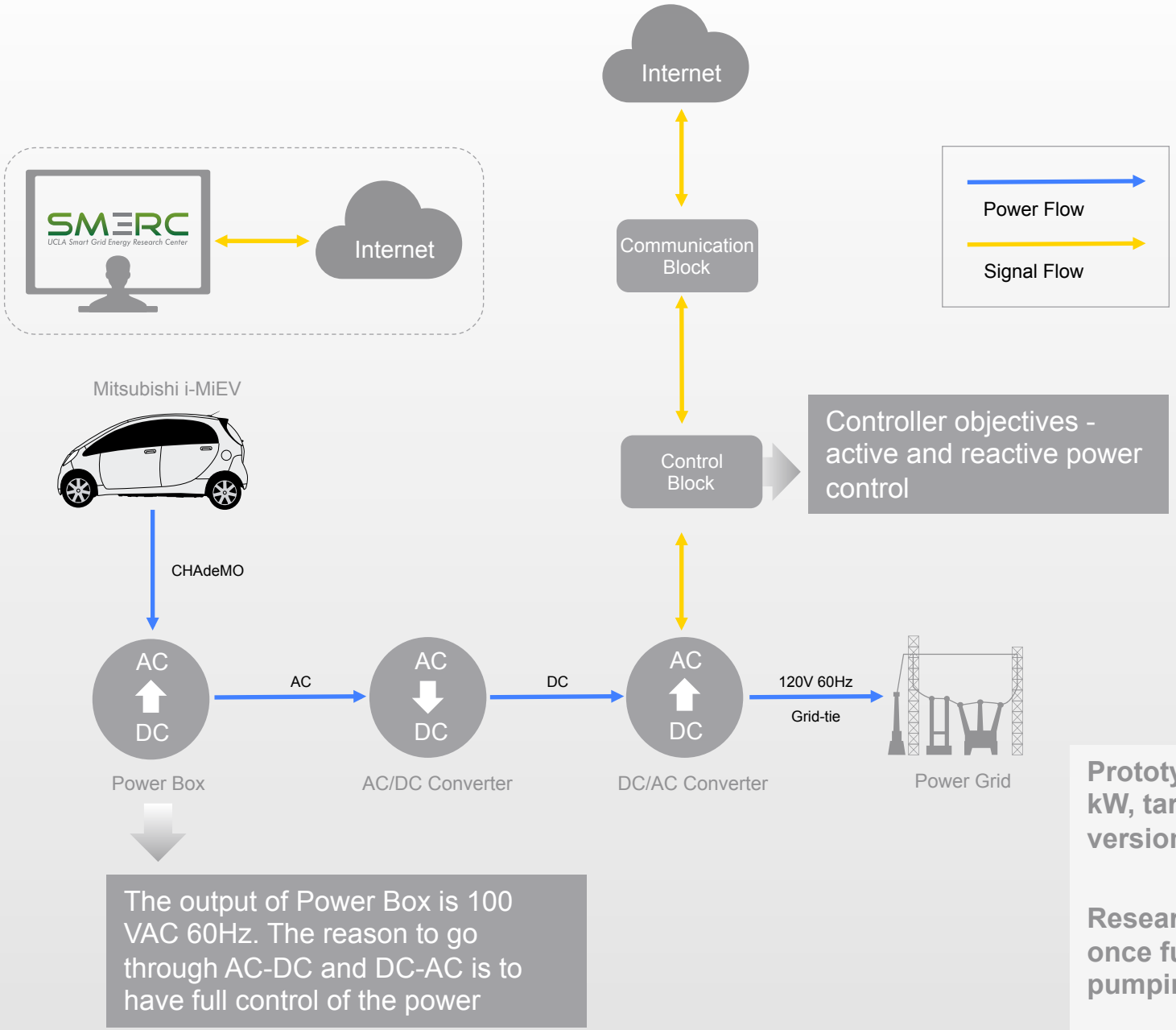


Modular Design for Interoperability with existing Technologies & Standards

Vehicle to Grid (V2G)

Phd Student, **Yubo Wang**, and SMERC Director, **Rajit Gadh**, testing vehicle to grid sytem with the Mitsubishi i-MIEV.

V2G System Architecture



Prototype system designed at 1.5 kW, targeting at 5 kW for next version

Research on discharging protocol, once fully understood, power pumping can go up to 50 kW

Energy Storage to reduce peak load during rapid charging

CHADEMO Installation in UCLA Parking Lot 4

Used EV battery storage for peak load reduction caused due to rapid charging

❖ Problem Description:

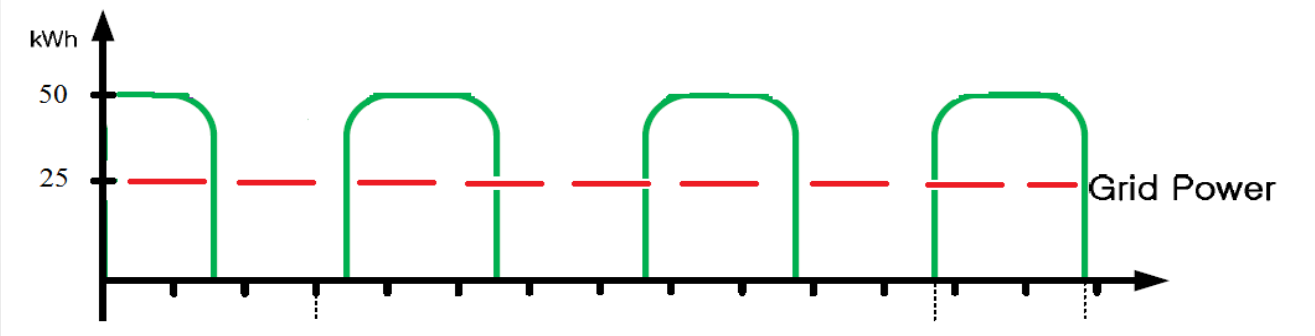
EVs become more and more popular

- ➢ Charging of EVs increases peak demand
- ➢ Charging of EVs may cause electric power shortage
- ➢ Waiting time for charging might be another issue.

❖ Solution

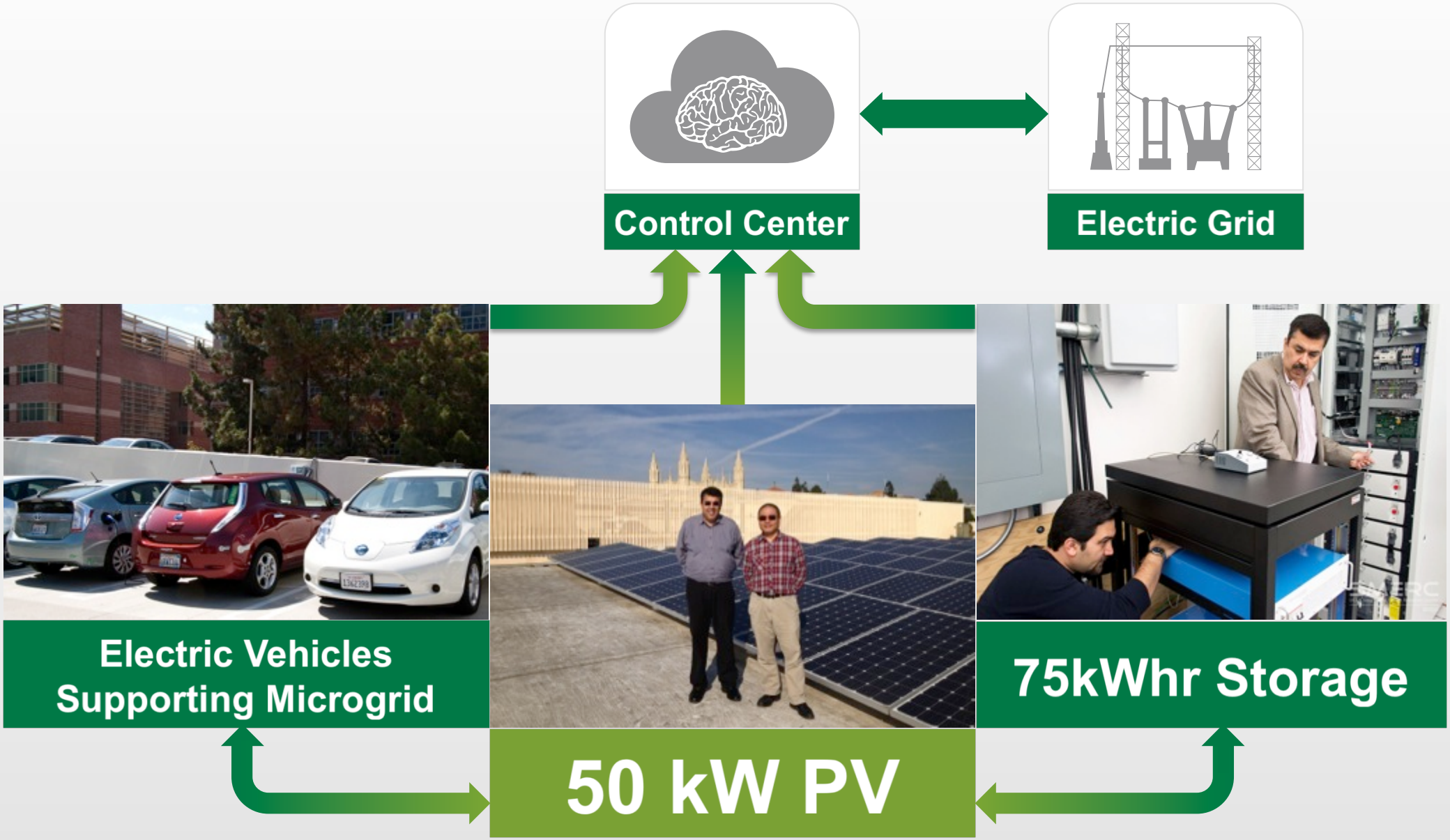
Integration of Battery storage system to the grid

- ➢ Cutting the peak demand

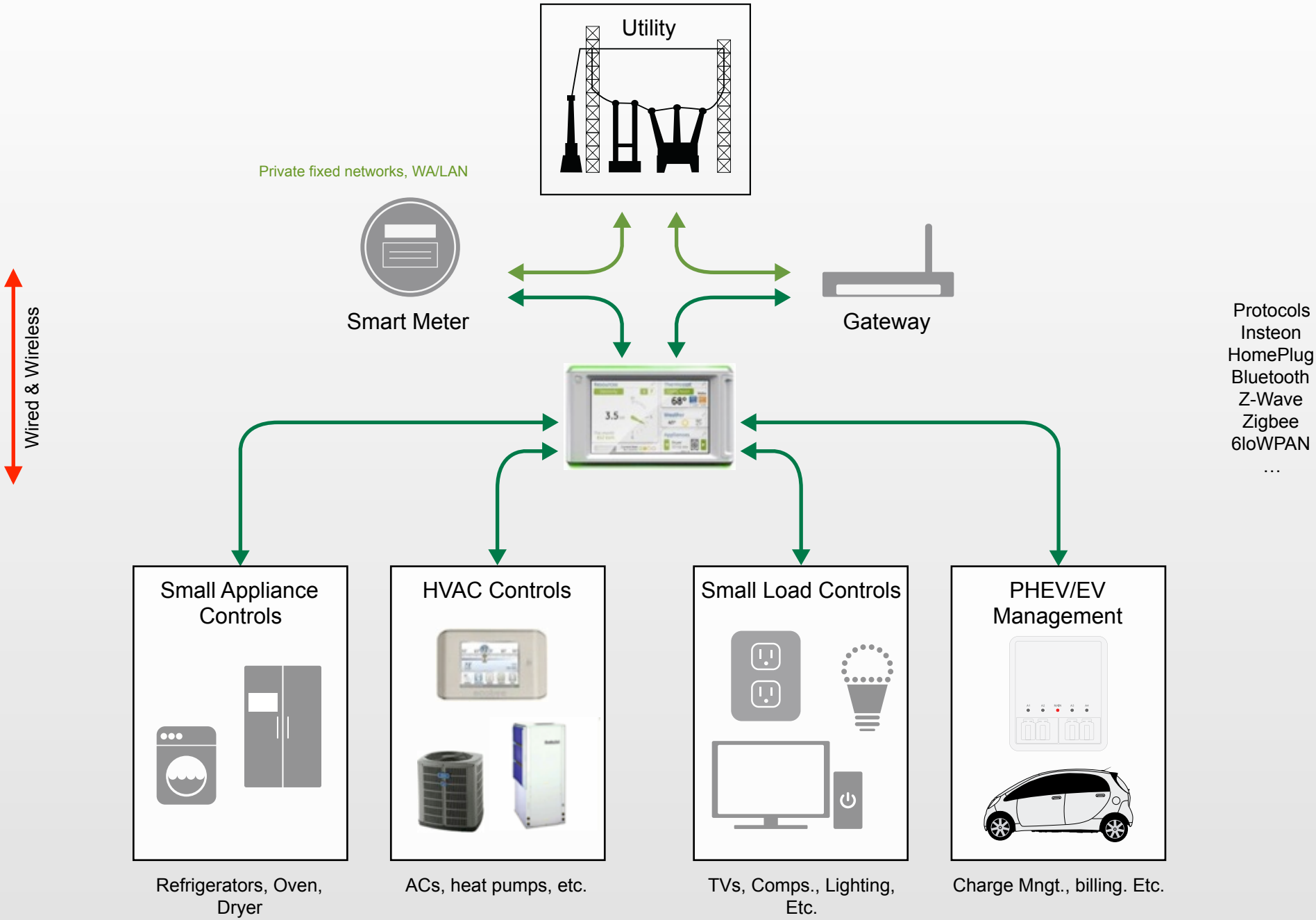


- ➢ Providing backup for the system
- ➢ Shifting the power demand profile
- ➢ Improving loading factors, voltage and frequency control
- ➢ Improving the reliability of supplies.

Renewable Integration in Microgrids with EV - technology demonstration



UCLA Demand Response Research and Demonstration



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THANK YOU